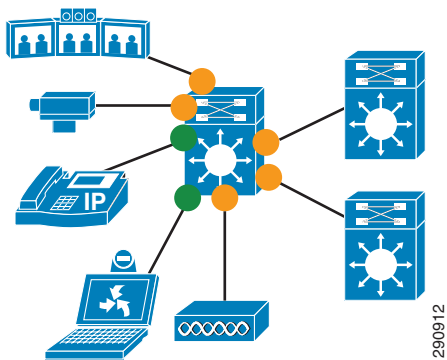


Role in Campus Network

The Cisco Catalyst 4500 series switches with Supervisor 6-E/7-E/8-E are well-suited to the role of access- or distribution-layer switches in campus networks. As such, these switches may connect directly to a variety of endpoints, as well as to distribution-layer and/or core-layer switches, as shown in Figure 1.

Figure 1 Cisco Catalyst 4500 Series Switch with Supervisor 6-E/7-E/8-E in a Campus Network



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QoS Design Steps

There are only two main steps to configure QoS on a Cisco Catalyst 4500 series switch with Supervisor 6-E/7-E/8-E:

1. Configure Ingress QoS Model(s):
 - Trust DSCP Model
 - Conditional Trust Model
 - Service Policy Models
2. Configure Egress Queuing

Step 1: Configure Ingress QoS Model(s)

The three most utilized ingress QoS models for campus networks are:

- Trust DSCP Model
- Conditional Trust Model
- Service Policy Models

Combinations of these ingress QoS models may be used at the same time.

Trust DSCP Model

By default all interfaces trust DSCP; as such, no explicit configuration is required to enable this model.

In the default trust DSCP state, the interface statically accepts and preserves the Layer 3 DSCP markings of all incoming packets. This model is suitable for interfaces connecting to endpoints that can mark DSCP values and are administratively controlled (such as WLAN controllers) as well as for any uplinks to distribution layer switches. Switch ports that should trust DSCP are shown as yellow circles in Figure 1.

Conditional Trust Model

The Conditional Trust model configures the interface to dynamically accept markings from endpoints that have met a specific condition, such as a successful CDP negotiation (switch ports set to conditional trust are shown as green circles in Figure 1).

This model is suitable for switch ports connecting to:

- Cisco IP phones—**trust device cisco-phone**
- Cisco TelePresence Systems—**trust device cts**
- Cisco IP Video Surveillance cameras—**trust device ip-camera**
- Cisco Digital Media Players—**trust device media-player**

This model is also suitable for PCs and untrusted devices, since the ports connecting to such devices will remain in their default untrusted state.

Service Policy Models

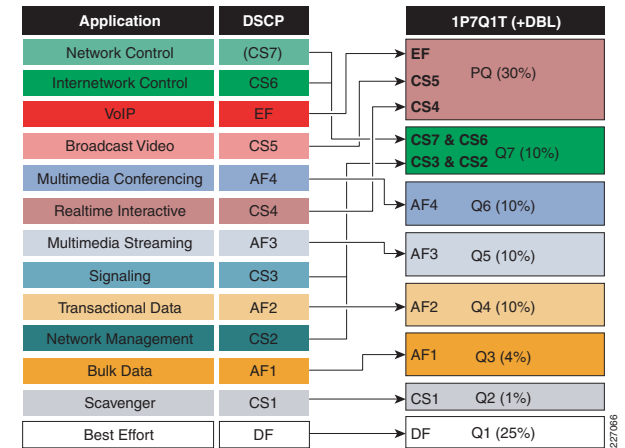
There may be cases where administrators require more detailed or granular policies on their ingress edges and as such they may construct MQC policies to implement classification, marking, and/or policing policies. These policies are constructed with:

- class-maps which identify the flows using packet markings or by access-lists or other criteria
- policy-maps which specify policy actions to be taken on a class-by-class basis
- service-policy statements which apply a specific policy-map to an interface(s) and specify direction

Step 2: Configure Egress Queuing

The egress queuing model for the Catalyst 4500 with Supervisor 6-E/7-E/8-E is shown in Figure 2.

Figure 2 Cisco Catalyst 4500 Supervisor 6-E / 7-E / 8-E Egress Queuing Model



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EtherChannel QoS

Ingress QoS policies (such as classification & marking policies) on the Cisco Catalyst 4500 Supervisor 6-E/7-E/8-E are configured on the logical Port-Channel interface (but typically these are simply to enable DSCP trust—which requires no explicit configuration). Egress QoS policies (such as the service-policy-statement to enable egress queuing) are configured on the physical port-member interfaces.

Cisco Validated Design (CVD)

The Cisco Validated Design for Cisco Catalyst 4500 with Supervisor 6-E/7-E/8-E in the role of an access switch in a campus network is presented below.

Step 1: Configure Ingress QoS Model :**Trust DSCP Model :**

```
<no configuration/default state>
```

Conditional Trust Model :

```
class-map match-all VOICE
  match cos 5
class-map match-all SIGNALING
  match cos 3
```

policy-map CISCO-IPPHONE

```
class VOICE
  set dscp ef
class SIGNALING
  set dscp cs3
class class-default
  set dscp default
```

```
qos trust device cisco-phone
service-policy input CISCO-IPPHONE
```

Service Policy Models :

```
[class-maps omitted for brevity]
```

```
policy-map MARKING-POLICY
  class VOIP
    set dscp ef
  class MULTIMEDIA-CONFERENCING
    set dscp af41
  class SIGNALING
    set dscp cs3
  class TRANSACTIONAL-DATA
    set dscp af21
  class BULK-DATA
    set dscp af11
  class SCAVENGER
    set dscp cs1
  class class-default
    set dscp default
```

```
service-policy input MARKING-POLICY
```

Step 2 : Egress Queuing Configuration

```
class-map match-any PRIORITY-QUEUE
  match dscp ef
  match dscp cs5
  match dscp cs4
class-map match-any CONTROL-MGMT-QUEUE
  match dscp cs7
  match dscp cs6
  match dscp cs3
  match dscp cs2
class-map match-all MULTIMEDIA-CONFERENCING-QUEUE
  match dscp af41 af42 af43
class-map match-all MULTIMEDIA-STREAMING-QUEUE
  match dscp af31 af32 af33
class-map match-all TRANSACTIONAL-DATA-QUEUE
  match dscp af21 af22 af23
class-map match-all BULK-DATA-QUEUE
  match dscp af11 af12 af13
class-map match-all SCAVENGER-QUEUE
  match dscp cs1
```

Assigns VoIP (EF)
Broadcast Video (CS5) and
Realtime Interactive (CS4) to the PRIORITY-QUEUE

Assigns Network Control (CS7), Internetwork Control (CS6),
Signaling (CS3) and Management (CS2) to the
CONTROL-MGMT-QUEUE

Assigns AF4 to the
MULTIMEDIA-CONFERENCING-QUEUE

Assigns AF3 to the
MULTIMEDIA-STREAMING-QUEUE

Assigns AF2 to the
TRANSACTIONAL-DATA-QUEUE

Assigns AF1 to the
BULK-DATA-QUEUE

Assigns CS1 to the
SCAVENGER-QUEUE

policy-map EGRESS-QUEUING

```
class PRIORITY-QUEUE
  priority
class CONTROL-MGMT-QUEUE
  bandwidth remaining percent 10
class MULTIMEDIA-CONFERENCING-QUEUE
  bandwidth remaining percent 10
class MULTIMEDIA-STREAMING-QUEUE
  bandwidth remaining percent 10
class TRANSACTIONAL-DATA-QUEUE
  bandwidth remaining percent 10
  db1
class BULK-DATA-QUEUE
  bandwidth remaining percent 4
  db1
class SCAVENGER-QUEUE
  bandwidth remaining percent 1
class class-default
  bandwidth remaining percent 25
  db1
```

PRIORITY-QUEUE gets strict priority servicing
(All other queues get percentages of bandwidth *remaining*
after the PQ has been fully serviced)

CONTROL-MGMT-QUEUE gets 10% of remaining bandwidth

MM-CONF-QUEUE gets 10% of remaining bandwidth

MM-STREAMING-QUEUE gets 10% of remaining bandwidth

TRANS-DATA-QUEUE gets 10% of remaining bandwidth
and Dynamic Buffer Limiting

BULK-DATA-QUEUE gets 4% of remaining bandwidth
and Dynamic Buffer Limiting

SCAVENGER-QUEUE is limited to 1% of remaining bandwidth

Default (Best-Effort) queue 25% of remaining bandwidth
and Dynamic Buffer Limiting

```
service-policy output EGRESS-QUEUING
```

Applies EGRESS-QUEUING policy to interface

Note: Highlighted commands are interface specific; otherwise these are global.

For more details, see Campus QoS Design 4.0:

http://www.cisco.com/en/US/docs/solutions/Enterprise/WAN_and_MAN/QoS_SRND_40/QoS_Campus_40.html

And the Cisco Press Book: **End-to-End QoS Network Design** (Second Edition)-Chapter 15

